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EXPERIMENTAL STIMULATION BY BURST-FIRING WEAK MAGNETIC FIELDS OVER THE RIGHT TEMPORAL LOBE MAY FACILITATE APPREHENSION IN WOMEN [1]

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Summary.—Intermittent bursts of weak magnetic fields whose patterns simulate normal amygdaloidal-hippocampal activity were generated by computer over the right or left temporal regions of men and women during partial sensory deprivation. As predicted, women but not men reported greater apprehension during right-hemispheric but not left-hemispheric stimulation. Intrusions of right-hemispheric processes have been hypothesized to affect self-esteem adversely. These results also support the role of the right parahippocampal region in the production of panic attacks.

Greater neuroelectrical (and metabolic) activity within the right relative to the left temporal and limbic lobes has been associated with experiences of anxiety and panic attacks within clinical and experimental contexts (Reiman, Fussellman, Fox, & Raichle, 1989). We have argued that frequent intrusions of right (primarily) temporal lobe processes into the left-hemispheric representations of the sense of self contribute to low self-esteem (Persinger & Makarec, 1991a). An intrusion is defined as a neuroelectrical pattern that normally would not intercalate with the ongoing process (Persinger, 1992).

Lowered self-esteem would be associated with negative affect, which the right hemisphere presumably and primarily subserves (Kuhar, 1986), and should be more frequent among normal women than men because of the greater coherence (less specialization) between hemispheres. Such sexual dimorphism in brain function could explain the greater incidence of panic attacks and phobias in normal women (Sheehan, 1982); these negative experiences could limit the development of their potential within certain social contexts (Persinger & Makarec, 1991b).

If this process were as robust as we have hypothesized, then apprehension should be generated more in women than in men when the right temporal lobe is stimulated by weak magnetic fields whose patterns simulate normal activity. Apprehension would be expected because resonance interaction should occur between aggregates of cells within the electrically labile right amygdaloid-parahippocampal region and the applied complex magnetic fields that were programmed to imitate the natural burst-firing profile. Our working metaphor is that we "talk to brain cells by simulating their language."

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We have found that homogeneous application of weak (1 milligauss, mG) burst firing patterns evokes alterations in affect that are evident within both subjective experiences and the emotional ratings of words that were utilized to describe these experiences (Richards, Persinger, & Koren, 1992). The present study is the first experiment in which we have experimentally altered the relative field strengths over the left and right temporal lobes; the person who interacted with the subjects was unaware of the hypothesis.

A total of 24 (12 men, 12 women) subjects volunteered for the study; their ages ranged between 19 and 25 years of age. Each subject sat in a comfortable chair within an acoustic chamber wherein the ambient light was generated by a red photographic development bulb (about 1 lux). A modified motorcycle helmet within which was embedded four pairs of solenoids on each side along the plane of the temporal lobes was worn during the experiment. About two weeks before the experiment each subject had completed the Personal Philosophy Inventory (Persinger & Makarec, 1987); the clusters that infer complex partial epileptic-like signs (CPES), our index of temporal lobe sensitivity, control processes (yes responding), and the "right-hemispheric" factor (Persinger & Makarec, 1993) were assessed.

Each subject was stimulated over the right or the left temporal lobe for 20 min. Equal numbers of men and women received the treatments to each hemisphere. The burst-firing field pattern was generated for 1 sec. every 4 sec. for 20 min. by a Zenith Z159 personal computer using complex-wave generating hardware and software (Persinger, Koren, Makarec, Richards, & Youlton, 1991). A Metex M-3800 digital multimeter and sensor [Electric Field Measurement, W. Stockbridge, MA, 01266, (413)-637-1929] indicated that the field strength over the stimulated side was 70 to 90 mG while the residual over the nonstimulated side was 6 to 10 mG; within the occipital area, the field strength was less than 1 mG while within the frontal region the strengths ranged between 2 and 5 mG. At the end of the session, while the helmet was removed, the person was asked to complete an exit questionnaire. It contained 20 items (rating 0 to 2) that referred to the incidence of various mystical and affective experiences (Persinger, *et al.*, 1991).

Analyses of variance as a function of sex and hemisphere were completed for each item. There were no main hemispheric effects for any of the items. Women reported (all *df*s = 1,20) more experiences of vivid images ($F = 6.63$, $p < 0.05$) and perseveration of the same idea ($F = 4.18$, $p < 0.05$) than did the men. The only statistically significant interactions of hemisphere by sex occurred for the items, "I experienced fear or terror" ($F_{1,20} = 6.08$, $p < 0.05$) and "There were pleasant vibrations moving through my body." The last interaction was due to men who received the left-hemispheric stimulation experiencing (reporting) more vibrations than those who received the right stimulation; the reverse occurred (more vibrations with right-hemispheric stimulation) for the women.

The interaction of sex by hemisphere for the apprehensive experience was based primarily on the higher scores for women who received right temporal-lobe stimulation .8 (.4) relative to the men (0). The scores for men and women who received left temporal-lobe stimulation were .3 (.5) and .3 (.5), respectively. A Kruskal-Wallis comparison (because variance in one group was zero) among the four groups was also statistically significant ($\chi^2 = 8.30$, $p < 0.05$). [Note the women who reported apprehension did not report pleasant vibrations.]

Covariance for complex partial epileptic signs or a cluster of items that refer to a history of experiencing a sensed presence eliminated the statistically significant sex differences ($F_{1,19} < 3.20$, $p < 0.05$). Only the interactions of sex by hemisphere for the apprehension experience (Fs = 5.44, 6.88, respectively) and pleasant vibrations (Fs = 6.61, 4.89) remained statistically significant.

These results are commensurate with the report of apprehension, an experience of presence, and a history of a sensed presence that were correlated with higher ratios of right temporal lobe to left spontaneous temporal lobe theta activity in normal women (Munro & Persinger, 1992). A personal history of intermittent intrusions of right temporal lobe or parahippocampal gyrus-mediated vigilance or fear would be expected to affect adversely the sense of self and to promote low self-esteem as well as the formation of fears and phobias.

Alternatively, the right-hemispheric stimulation may have produced these experiences in both sexes; however, the women may have reported them while the men did not. The more frequent intrusions of right-hemispheric processes in women would facilitate labeling and awareness of these experiences. We have found consistently that women more than men admit more readily to routine phenomenological experiences and may be more aware of them. That these experimentally induced sensations were not excessively traumatic was indicated by the absence of statistically significant differences ($F_{2,21} = 0.62$, $p > 0.05$) between the over-all rating (−2 to + 2) of the chamber experience for the women who reported apprehension [.7 (.5)] compared with those of the women who did not report any apprehension [1.1 (1.0)] and with the men [1.1 (.8)]. In addition, none of the volunteers terminated the experiment even though they were told they could utilize this option at any time.

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